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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,798	09/30/2003	T. Warren Weeks JR.	N0400.70001US01	2233

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EXAMINER

BLACKWELL, GWENDOLYN ANNETTE

ART UNIT	PAPER NUMBER
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1794

MAIL DATE	DELIVERY MODE
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11/28/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/675,798

Applicant(s)

WEEKS ET AL.

Examiner

Gwendolyn Blackwell

Art Unit

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 August 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,7-14,18-28,30-35 and 86-90 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,7-14,18-28,30-35 and 86-90 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 9/20/2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102/103

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 4, 7-14, 18-28, 33-35, and 87-90 are under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over United States Patent no. 5,874,747, Redwing et al.

Regarding claims 1, 4, 7-14, 19, 33-35, and 87-90

Redwing discloses a GaN alloy layer grown on a substrate that can be SiC or Si with a transition layer grown between the substrate and the GaN layer, (column 4, lines 62-65). The gallium nitride can be single crystal, (column 7, lines 8-12).

There are no specific examples utilizing a Si substrate instead of a SiC substrate. In the alternative it would have been obvious to one skilled in the art at the time of invention to use Si instead of SiC as Redwing specifically discloses that “[t]he quality of GaN grown on lattice mismatched substrates such as sapphire, Si, GaAs and SiC is greatly improved when a buffer or transition layer is grown on the substrate prior to the growth of the GaN layer”, (column 4, lines 62-65). An intermediate layer may be placed between the substrate and the transition layer, (column 19, lines 23-29). The intermediate layer can be a thin layer of AlN, or can be comprised of a thin compositionally graded buffer layer alloy of gallium nitride such as (Al, In)N, (Al, Ga)N, (Al, Ga, In)N, (In, Ga)N, (columns 19-20, lines 23-19), meeting the requirements of claims 1, 9, 19, and 33-35.

The transition layer comprises gallium nitride, which is compositionally graded comprising the formulas $Al_xGa_{1-x}N$ where the value of x ranges from 0 to 1. The value of x can be 0 to 1 starting from the substrate or 1 to 0 starting from the substrate, (column 7, lines 15-30), meeting the requirements of claims 4, 7-8, 11-13, and 87-90.

The composition of gallium nitride can also be $In_xGa_{1-x}N$ with the range of $0.05 < x < 0.5$ and $Al_yGa_{1-y}N$ where y ranges between 0 to 0.3, (column 14, lines 18-22), meeting the requirements of claim 10.

The composition of the transition layers can be continuous along the thickness or graded stepwise or incrementally, (column 22, lines 39-47), meeting the requirements for claim 14.

Regarding claim 20

Redwing also discloses that the gallium nitride may be a superlattice such as $M_{1-x-y}M'_yGa_xN$ wherein x and y range from 0 to 1 and M is a metal compatible with Ga and N and M' is a compatible metal providing quaternary compounds such as AlInGaN, (column 14, lines 46-68; see also claims 25-30), meeting the requirement of claim 20.

Regarding claims 18, 21-24, and 26-28

Redwing further discloses that the transition layer has a thickness between 200 angstroms to 5 μm , meeting the requirements of claims 18 and 21, (column 7, lines 30-32).

The invention of Redwing can be a LED, LD, or semiconductor device, (column 9, lines 55-60), meeting the requirements of claims 22-24.

The present invention has a structure, which eliminates cracking, (column 18, lines 53-56), meeting the requirements of claims 26-28.

Regarding claim 25

The phrase "wherein the semiconductor material forms a FET" is considered a statement of intended use. The intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Because the layer structure of Redwing et al is not structurally

different from the semiconductor material as claimed by Applicant, the semiconductor material as claimed does not provide patentable distinction over the prior art of record.

Claim Rejections - 35 USC § 103

4. Claims 25, 30-31, and 86 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent no. 5,874,747, Redwing et al as applied to claims 1 and 22 above, in view of United States Patent no. 6,426,512 B1, Ito et al further in view of United States Patent no. 6,287,947, Ludowise et al.

Redwing et al disclose the limitations of claims 1 and 22 above. Redwing et al also disclose that the invention can be a LED, LD, or semiconductor device, (column 9, lines 55-60). The present invention has a structure that eliminates cracking, (column 18, lines 53-56). Redwing et al do not specifically disclose that the semiconductor device is an FET or the size of the substrate as exemplified by Applicant or that the silicon substrate is textured.

Ito et al disclose a semiconductor device that utilizes a group III nitride compound, such as GaN and it's alloys, wherein the substrate can be SiC or Si, (column 4, lines 50-67). Ito et al. also disclose that a "FET structure can be also formed from group III nitride compound semiconductors," (column 8, lines 56-65). Between the substrate and the GaN layer is an undercoat layer and a buffer layer, wherein the buffer layer is $\text{Al}_a\text{Ga}_{1-a}\text{N}$ ($0 \leq a \leq 1$), (column 16, lines 65-67). The thickness of the substrate can be 300 μm , (column 13, examples).

Ludowise et al disclose structures related to GaN based LEDs and LDs comprised of a substrate and a number of layers, (column 5, lines 47-48). The substrate can be comprised of

silicon containing materials wherein the surface of the substrate is textured, (column 5, lines 51-56).

Redwing et al, Ito et al, and Ludowise et al disclose analogous inventions related to better ways to improve the lattice mismatch between the GaN layer(s) and the substrate. It is known in the art that Si, SiC, and sapphire can be used as substrates in the manufacturing of FETs, LDs, and LEDs. It is also known that the lattice mismatch between GaN and a Si or SiC substrate can be decreased by the use of a buffer layer, (Redwing, col. 4, lines 62-65). It is also known that Si is less expensive than SiC when used a substrate for a semiconductor device. Therefore it would have been obvious to one skilled in the art at the time of invention to modify the semiconductor device of Redwing with the Si substrate of Ito to create a FET that is less expensive to manufacture. It would also be within the skill of one in the art at the time of invention to modify the substrate of the Redwing/Ito invention in order to randomize the incident light and increase the probability of incident light escaping the LED through the sides or upper surface of the semiconductor region, (column 5, lines 47-62).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to adjust the diameter of the substrate through routine experimentation in order to achieve a semiconductor device that has improved structural and optical properties. It has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

5. Applicant's arguments filed August 30, 2007 have been fully considered but they are not persuasive with respect to the rejections of claims 1, 4, 7-14, 18-28, 32-35, and 87-90 under 35 U.S.C. 102(b)/103(a) and claims 25, 30-31, and 86 under 35 U.S.C. 103(a).

6. With regards to the 35 U.S.C. 102(b)/103(a) rejection, Applicant contends that USPN 5,874,747, Redwing, (1) does not disclose growing a thick gallium nitride material having a low crack level on a silicon substrate as Redwing only generally teaches that gallium nitride can be grown on silicon in the background of the section of the patent, (2) teaches away from the claimed invention, (3) is concerned with optical properties that would not be available if a silicon substrate is used, and (4) there would have been no expectation of success based on the teaching of the prior art.

With regards to contentions (1) and (2), this is not held persuasive as Redwing demonstrates that it is known to grown gallium nitride Redwing on a substrate that can be SiC or Si with a transition layer grown between the substrate and the GaN layer, (column 4, lines 62-65), (Also see Marchand, US 2002/0020341, which is already of record). As such is known, even though Redwings examples are to GaN grown on silicon carbide, it would be expected that one in the art could apply the same principles to grow GaN on silicon. The prior art's teachings are not limited to the preferred embodiments but the teaching as whole. A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments. *Merck & Co. v. Biocraft Laboratories*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), *cert. denied*, 493 U.S. 975 (1989). A reference is no less anticipatory

if, after disclosing the invention, the reference then disparages it. The question whether a reference "teaches away" from the invention is inapplicable to an anticipation analysis. *Celeritas Technologies Ltd. v. Rockwell International Corp.*, 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522-23 (Fed. Cir. 1998) (The prior art was held to anticipate the claims even though it taught away from the claimed invention. "The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed.")\

With regards to contentions (3) and (4), Applicant has not demonstrated through objective evidence that using the invention of Redwing with a silicon substrate would not work/be inoperable or that there is no reasonable expectation that the semiconductor material of claim 1 could not be successfully formed in view of the teachings of Redwing. Objective evidence which must be factually supported by an appropriate affidavit or declaration to be of probative value includes evidence of unexpected results, commercial success, solution of a long-felt need, inoperability of the prior art, invention before the date of the reference, and allegations that the author(s) of the prior art derived the disclosed subject matter from the applicant. The arguments of counsel cannot take the place of evidence in the record. *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965). *MPEP 716.01*.

7. With regards to the 35 U.S.C. 103(a) rejection, Applicant contends (5) that one skilled in the art would not be motivated to combine Redwing and USPN 6,426,512, Ito and 6,287,947, Ludowise et al and (6) that one skilled in the art would not have a reasonable expectation of success.

With regards to contentions (5) and (6), The same arguments stated above for the 102(b)/103(a) rejection are repeated to the Redwing reference applied in the 103(a) obviousness

rejection. Please see comments above. The concentration of Redwing on SiC as a substrate does not explicitly teach away from the use of silicon as Redwing has disclosed that silicon can be used as a substrate to grow GaN while utilizing a transition layer between the substrate and the GaN film.

The Examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, all three references teach the use of gallium nitride on a substrate comprising silicon, which makes up a semiconductor device. Ito is used to demonstrate that a structure having a GaN layer formed on SiC or Si can be used as an FET structure. Ludowise is used to demonstrate that GaN based LEDs and LDs, which are taught by Redwing, can be used on textured substrates comprised of silicon. Outside of arguments, Applicant has not provided any objective evidence to support their contents.

8. In view of the responses above, the rejections of claims 1, 4, 7-14, 18-28, 30-35, and 86-90 stand rejected under the appropriate 35 U.S.C. 102(b)/103(a) or 103(a).

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

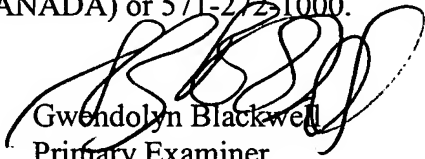
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gwendolyn Blackwell whose telephone number is (571) 272-1533. The examiner can normally be reached on Monday - Thursday; 6:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Gwendolyn Blackwell
Primary Examiner
Art Unit 1794